TWO TONE A.F. SIGNAL
GENERATOR TYPE 745

# INSTRUCTION MANUAL

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COLONIAL WAY, RADLETT ROAD, WATFORD, HERTS, ENGLAND.

# TWO TONE A.F. SIGNAL GENERATOR TYPE 745

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## 1. General

This Plug-In is designed to provide simultaneously two independent Audio signals for the evaluation of intermodulation distortion on Amplifiers, Transmission Links and Single Sideband Circuits. Each Audio Signal can also be used separately for straight harmonic distortion analysis.

It consists of two identical R-C tuned oscillators of high stability and very low harmonic distortion. The frequency and output level of these oscillators can be varied independently and the outputs are combined in a resistive adding network with negligible intermodulation and frequency pulling and fed to a common 600Ω output attenuator.

## 2. Specification

Each Oscillator

| | |
|---|---|
| Frequency Range: | 30c/s - 30Kc/s in three ranges. |
| Setting Accuracy: | 3% ± 3c/s |
| Frequency Stability (Short term): | 0·01% |
| Output Level: | 0-3V open circuit |
| Setting Accuracy: | ± ·5db |
| Harmonic Distortion: | 0·1% (less than 1% below 300c/s). |
| Hum and Noise: | 0·05% |

Overall Specification

| | |
|---|---|
| Inherent Intermodulation | Better than 80db |
| Output Attenuator: | 0-80db in 10db steps |
| Output Impedance: | 600Ω ±2% |

## 3. Operation

The Two Tone Signal Generator Plug-In is ready for use as received from the factory and when inserted into the Type 70 or 70/R Meter Unit will give the specified performance after about 15 minutes warm-up time. The main function switch in the centre of the front panel has three positions marked A, A & B and B. In the two extreme positions only signal A or signal B is switched to the output attenuator and hence the output terminals, but in the centre position both the signals are combined and at the same time the meter circuit which monitors the output level of the signals is disconnected as it would give a completely false reading. The frequency of each oscillator is set by the three position range switch and the continuous tuning dial and the output level by the appropriate level setting potentiometers. The output level attenuator which is common to both signals provides for setting the open circuit output voltage from 3 Volts down to 300μV when the meter reads full scale in 9 steps of 10db attenuation per step.

The internal output impedance of the instrument is 600Ω and constant irrespective of attenuator setting. Therefore the actual voltage V appearing across the output terminals will depend on the load resistance R and is given in terms of the open circuit voltage E as measured on the meter by the following formula

$$V = E \times \frac{R}{600+R}$$

4. Technical Description

The circuit diagram is shown in drawing BC.1189 and as the two oscillators are identical only Tone "A" Oscillator will be described. The oscillator used is of the "Wien Bridge" type where $V_1$ and $V_2$ comprise the maintaining amplifier. The triode section $V_2B$ is used as a directly coupled cathode follower to provide a low impedance output for the Wien Bridge feedback network. Positive feedback is applied via the Wien Bridge to the grid of $V_1$ which induces oscillations at the "resonant frequency" of the network while negative feedback is applied to the cathode of $V_1$ through the thermistor TH.1 to stabilise the output amplitude. The Wien Bridge network is switched in three stages by switch $S_1$ which brings in different values of capacitance for the different ranges and is continuously tuned across each range by the ganged potentiometer $RV_1$ and $RV_2$. Because both the H.T. and heater supply voltages of the oscillator valves are stabilised, this results in good frequency stability with mains variation and virtually no mains hum at the output.

The output voltage is taken from the cathode of V2B to the "Level" potentiometer RV5 and hence to the output cathode follower $V_3$. This is of the augmented type with additional feedback from the anode of V3A to the grid of V3B resulting in an output impedance of only a few ohms. This now drives, via the function switch S3, the star network of R40, R41 and R42 which combines the signals and applies them to the output attenuator. The signal is also applied to the rectifier MR3 and passed to the metering circuit via the pre-set potentiometer RV7.

The output attenuator is shown in drawing AC 1108 and consists of one 10db T-pad, one 20db T-pad and two 30db $\pi$-pads all of 600 ohms impedance. Switch S4 switches the various pads so as to get attenuation from 0 to 80db in 10db steps, i.e. an output voltage of 3V to 300μV in 3, 1, 0.3 sequence.

## PARTS LIST

| CIRCUIT REF. | DESCRIPTION | | |
|---|---|---|---|
| **ATTENUATOR** | | | |
| R50. | Resistor, Hi-Stab | 491Ω ± 1% | ¼W |
| R51. | Resistor, Hi-Stab | 312Ω ± 1% | ¼W |
| R52. | Resistor, Hi-Stab | 121Ω ± 1% | ¼W |
| R53. | Resistor, Hi-Stab | 312Ω ± 1% | ¼W |
| R54. | Resistor, Hi-Stab | 422Ω ± 1% | ¼W |
| R55. | Resistor, Hi-Stab | 491Ω ± 1% | ¼W |
| R56. | Resistor, Hi-Stab | 639Ω ± 1% | ¼W |
| R57. | Resistor, Hi-Stab | 639Ω ± 1% | ¼W |
| R58. | Resistor, Hi-Stab | 639Ω ± 1% | ¼W |
| R59. | Resistor, Hi-Stab | 9.5kΩ ± 1% | ¼W |
| R60. | Resistor, Hi-Stab | 639Ω ± 1% | ¼W |
| R61. | Resistor, Hi-Stab | 9.5kΩ ± 1% | ¼W |
| S4. | Switch | Dymar Drawing No. BD 1185 | |

# P A R T S  L I S T

| CIRCUIT REF. | DESCRIPTION | | | |
|---|---|---|---|---|
| **R E S I S T O R S** | | | | |
| R1. | Hi-Stab | 2·7KΩ | ± 1% | ¼W |
| R2. | " | 2·7KΩ | ± 1% | ¼W |
| R3. | " | 4·7KΩ | ± 1% | ¼W |
| R4. | " | 4·7KΩ | ± 1% | ¼W |
| R5. | Carbon | 100Ω | ± 5% | ½W |
| R6. | " | 100Ω | ± 5% | ½W |
| R7. | " | 15KΩ | ± 5% | ½W |
| R8. | " | 1KΩ | ± 5% | ½W |
| R9. | " | 15KΩ | ± 5% | ½W |
| R10. | " | 1KΩ | ± 5% | ½W |
| R11. | " | 1KΩ | ± 5% | ½W |
| R12. | " | 1MΩ | ± 5% | ½W |
| R13. | " | 1KΩ | ± 5% | ½W |
| R14. | " | 1MΩ | ± 5% | ½W |
| R15. | " | 33KΩ | ± 5% | ½W |
| R16. | " | 1KΩ | ± 5% | ½W |
| R17. | " | 33KΩ | ± 5% | ½W |
| R18. | " | 1KΩ | ± 5% | ½W |
| R19. | " | 33KΩ | ± 5% | ½W |
| R20. | " | 33KΩ | ± 5% | ½W |
| R21. | " | 10KΩ | ± 5% | 2W |
| R22. | Hi-Stab | 2·2KΩ | ± 1% | 1W |
| R23. | Carbon | 10KΩ | ± 5% | 2W |
| R24. | Hi-Stab | 2·2KΩ | ± 1% | 1W |
| R25. | Carbon | 1KΩ | ± 5% | 1W |
| R26. | " | 1·5MΩ | ± 5% | ½W |
| R27. | " | 1MΩ | ± 5% | ½W |
| R28. | " | 1KΩ | ± 5% | 1W |
| R29. | " | 1·5MΩ | ± 5% | ½W |
| R30. | " | 1MΩ | ± 5% | ½W |
| R31. | " | 1MΩ | ± 5% | ½W |
| R32. | " | 1MΩ | ± 5% | ½W |
| R33. | " | 2·7KΩ | ± 5% | 1W |

# P A R T S  L I S T

| CIRCUIT REF. | DESCRIPTION | |
|---|---|---|

## R E S I S T O R S

| | | | | |
|---|---|---|---|---|
| R34. | Carbon | 2·2KΩ | ± 5% | ½W |
| R35. | " | 2·7KΩ | ± 5% | 1W |
| R36. | " | 2·2KΩ | ± 5% | ½W |
| R37. | " | 1KΩ | ± 5% | 1W |
| R38. | " | 1KΩ | ± 5% | 1W |
| R39. | " | 1KΩ | ± 5% | ½W |
| R40. | Hi-Stab | 1·8KΩ | ± 1% | ¼W |
| R41. | " | 1·8KΩ | ± 1% | ¼W |
| R42. | " | 1·8KΩ | ± 1% | ¼W |
| R43. | " | 100KΩ | ± 1% | ¼W |
| R44. | Carbon | 22K | ± 5% | 1/3W |
| R45. | " | 22K | ± 5% | 1/3W |

| | | |
|---|---|---|
| RV1.) RV2.) | Dual Ganged potentiometer Inverse semi-log law, 50KΩ ± 5% | |
| RV3.) RV4.) | Dual Ganged potentiometer Inverse semi-log law, 50KΩ ± 5% | |
| RV5. | Potentiometer, linear 100KΩ | ½ watt |
| RV6. | Potentiometer, linear 100KΩ | ½ watt |
| RV7. | Potentiometer, linear 22K | |

## C A P A C I T O R S

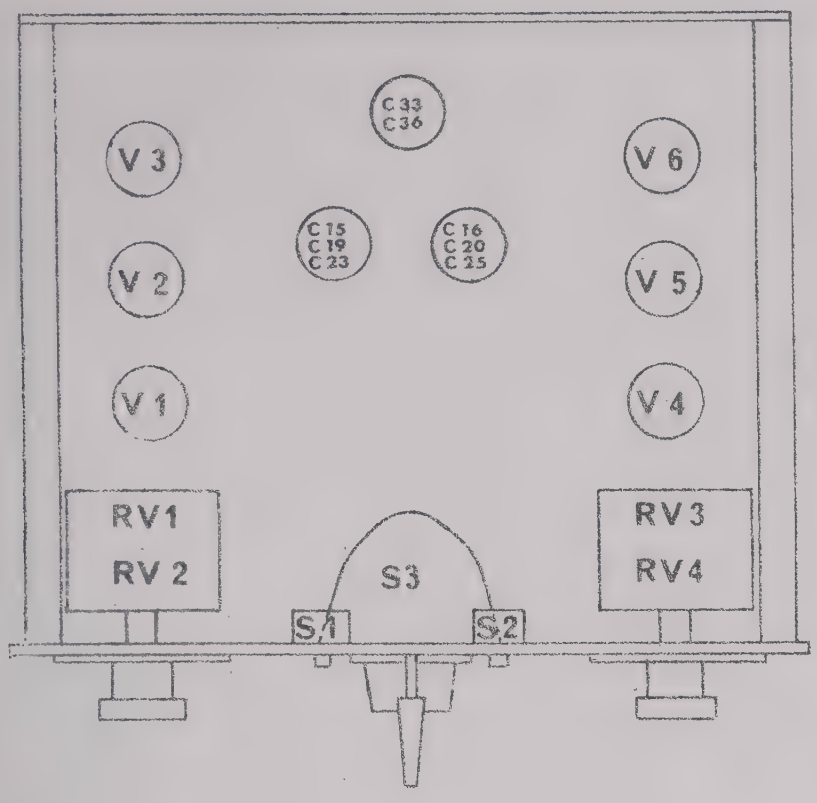
| | | | |
|---|---|---|---|
| C1. | Plastic Film | 0·1μF | 160V d.c. |
| C2. | " " | 0·1μF | 160V d.c. |
| C3. | Polystyrene | 0·01μF | 125V d.c. |
| C4. | " | 0·01μF | 125V d.c. |
| C5. | " | 940pf | 125V d.c. |
| C6. | " | 940pf | 125V d.c. |
| C7. | " | 940pf | 125V d.c. |
| C8. | " | 940pf | 125V d.c. |

## P A R T S  L I S T

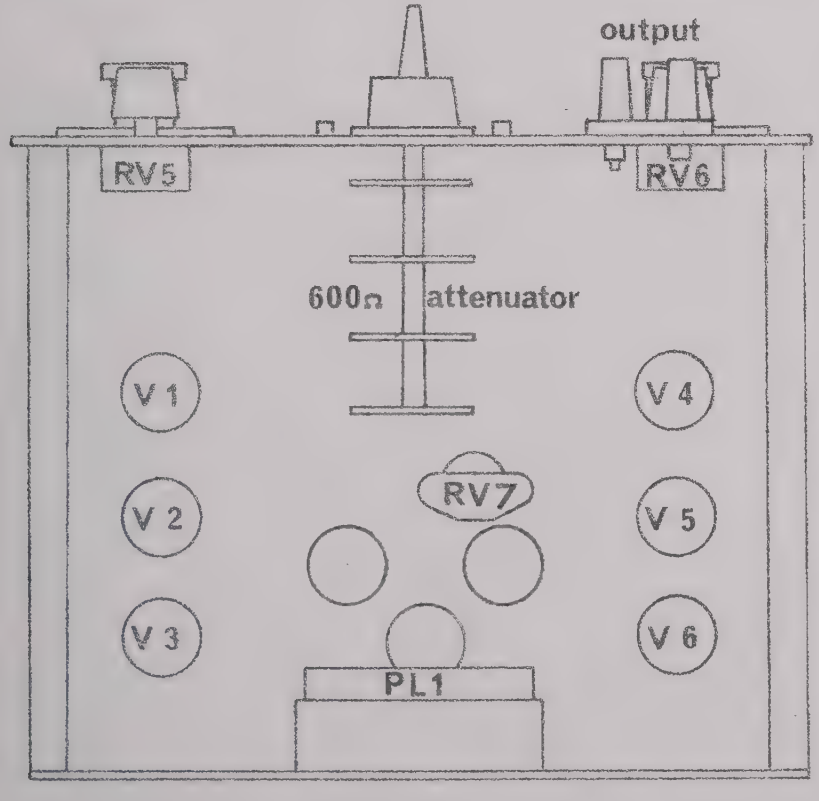
| CIRCUIT REF. | DESCRIPTION | | |
|---|---|---|---|
| | **C A P A C I T O R S** | | |
| C9. | Polystyrene | 0.01µF | 125V d.c. |
| C10. | " | 0.01µF | 125V d.c. |
| C11. | Plastic Film | 0.1µF | 160V d.c. |
| C12. | Plastic Film | 0.1µF | 160V d.c. |
| C13. | Polyester | ·47µF | 400V d.c. |
| C14. | " | ·47µF | 400V d.c. |
| C15. | Electrolytic | 16+16+16µF | 275V d.c. |
| C16. | Electrolytic | 16+16+16µF | 275V d.c. |
| C17. | Polystyrene | 100pF | 125V d.c. |
| C18. | " | 100pF | 125V d.c. |
| C19. | See C.15 | | |
| C20. | See C.16 | | |
| C21. | Electrolytic | 8µF | 150V d.c. |
| C22. | " | 8µF | 150V d.c. |
| C23. | See C.15 | | |
| C24. | Polyester | ·47µF | 400V d.c. |
| C25. | See C.16 | | |
| C26. | Polyester | ·47µF | 400V d.c. |
| C27. | " | ·1µF | 400V d.c. |
| C28. | " | ·1µF | 400V d.c. |
| C29. | " | ·047 | 400V d.c. |
| C30. | " | ·047 | 400V d.c. |
| C31. | Electrolytic | 50µF | 150V d.c. |
| C32. | " | 100µF | 12V d.c. |
| C33. | " | 50+50µF | 275V d.c. |
| C34. | " | 50µF | 150V d.c. |
| C35. | " | 100µF | 12V d.c. |
| C36. | See C.33 | | |
| C37. | Electrolytic | 8µF | 150V d.c. |

# P A R T S  L I S T

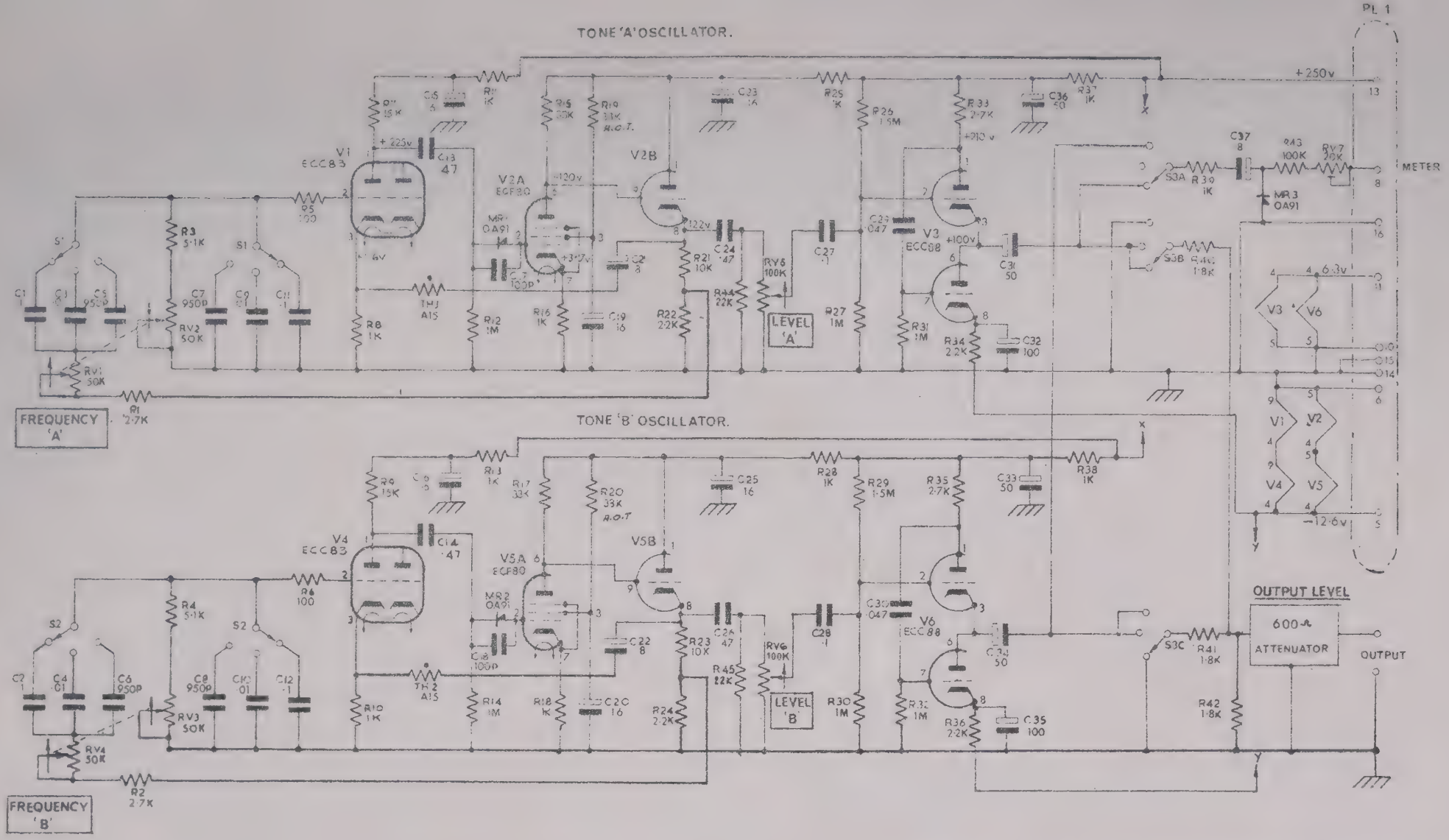
| CIRCUIT REF. | DESCRIPTION | | |
|---|---|---|---|
| | **V A L V E S** | | |
| V1. | Double Triode | ECC83 | Mullard |
| V2. | Triode-Pentode | ECF80 | Mullard |
| V3. | Double-Triode | ECC88 | Mullard |
| V4. | Double-Triode | ECC83 | Mullard |
| V5. | Triode-Pentode | ECF80 | Mullard |
| V6. | Double-Triode | ECC88 | Mullard |
| | **M I S C E L L A N E O U S** | | |
| MR1. | Diode | OA91 | Mullard |
| MR2. | Diode | OA91 | Mullard |
| MR3. | Diode | OA91 | Mullard |
| TH1. | Thermistor | A15 | S.T.C. Ltd., |
| TH2. | Thermistor | A15 | S.T.C. Ltd. |
| PL1. | Plug 16-way Dowel Polarized | | McMurdo R.P.D.16. |
| S1. | Switch, slider type RA2300 | | Ariel Ltd. |
| S2. | Switch, slider type RA2300 | | Ariel Ltd. |
| S3. | Switch Dymar Drg. No. BD1192 | | |




VIEW ON TOP OF CHASSIS

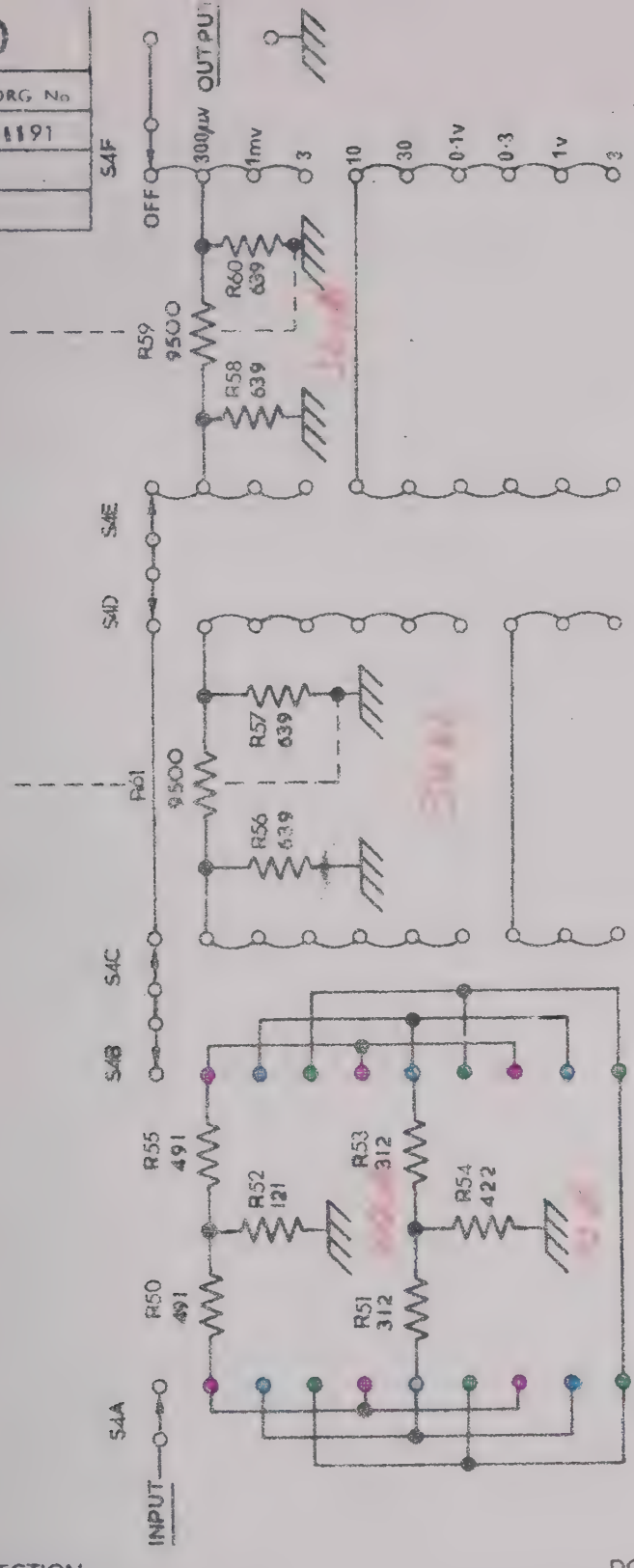



VIEW UNDER CHASSIS




# TWO TONE A.F. SIGNAL GENERATOR TYPE 745.

| AC1190 | |
|---|---|
| USED ON | ASSY DRG No |
| TYPE 745 | DA1191 |
| | |
| | |




80db. OUTPUT ATTENUATOR.

THIRD ANGLE PROJECTION

DO NOT SCALE

| ISSUE | |
|---|---|
| A. 6-12-65. | |

LIMITS UNLESS OTHERWISE STATED AS FOLLOWS

FRACTIONAL DIMENSIONS ± ·015 CLEAR HOLES ± ·005

DECIMAL DIMENSIONS ± ·005 ANGLES ± ½°

DIMENSIONS APPLY BEFORE PLATING UNLESS OTHERWISE STATED

MAT'L — SPEC. —

FINISH —

ALL DIMENSIONS IN INCHES SCALE

**DYMAR ELECTRONICS LTD.**

WATFORD, HERTS, ENGLAND.

TITLE CIRCUIT DIAGRAM.
TWO TONE A.F. SIGNAL GENERATOR
OUTPUT ATTENUATOR.

DRG. No AC1190

DRN D.A.RUSSELL DATE 27-2-65

CHK'D DATE

APP'D. DATE

# G U A R A N T E E

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In the event of failure of malfunctioning of any equipment supplied by us please contact our Service Department, at the below stated address and give full details of the fault together with the Type and Serial Number of the equipment in question.

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